WEATHER AND HAY IN NEW YORK STATE

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In an important dairy State, such as New York, hay necessarily plays a prominent part in the prosperity of the community. Next to dairy products in point of value comes hay, the total hay crop being worth well over $96,000,000. The tremendous value of this crop in comparison with the better known grain crops, such as corn, wheat, oats, and barley, makes it of great economic importance, and any weather factor which influences production is reflected in the well being of the State.

It has long been known that ample moisture is of great importance to hay, and the period which affects the yield most has been determined as the spring months. Temperature is of only secondary importance, as well moistened soil will usually promote favorable growth within a rather wide range of temperature conditions.

Smith (*1*) found that May rainfall was the most important factor in hay production, and further that in New York State normal rainfall was most favorable. In this connection he states that the hay crop apparently does not utilize much more than normal rainfall. I have made a series of correlations for the period 1894–1923 to check this observation and to attempt to find a more definite relation between weather and yield. The coefficients of correlation for the various months from April to July are given in the following table:

	April	May	June	July	August
Precipitation	0.34±0.11	0.36±0.11	0.42±0.10	0.14±0.12	0.13±0.12
Temperature	−.28± .11	−.44± .10	−.39± .10	−.05± .12	

These results show that June rainfall and May temperature exert the greatest influence on the yield.

This single series of coefficients was not sufficiently satisfactory, so various months were combined and it was found that the May and June mean temperatures and April to June precipitation were of much greater importance than temperature or precipitation for any single month. The coefficient for May and June temperature was -0.60 ± 0.08 or over seven times the probable error, and the April to June rainfall coefficient was 0.68 ± 0.07, or over nine times the probable error. These coefficients are sufficiently high to indicate a very definite relation between the weather variables and yield.

Figure 1 shows graphically the relation to yield of certain combinations of temperature and rainfall conditions, such as cool and wet, cool and dry, warm and wet, and warm and dry, the plus signs indicating yields above normal and the minus below normal.

Whenever the spring weather was warm and dry, hay was seriously affected. In fact, every time that warm, dry weather prevailed in this period the yield was below normal. Whenever it was either warm and wet, cool and wet, or cool and dry the hay yield was not seriously reduced, because the usually ample moisture offset possible adverse temperature effects.

The results of this charting prompted an attempt to use the multiple correlation method described by Wallace (*2*). This gives a coefficient of 0.85 ± 0.03, or a coefficient 28 times the probable error, showing conclusively a very definite and close relation. The inclusion, in addition to these factors, of the seasonal precipitation increased the coefficient to 0.87, but this is probably not of much value as the April to June rainfall had been included already.

The regression equation for the two variables and the yield was: $\overline{X}=-.05A+.06B+3.62$, where A is the May and June mean temperature and B the April to June rainfall. The computed and actual yields in tons per acre for the period under consideration are given below.

Years	Computed yields	Actual yields	Difference
1894	1.22	1.17	0.05
1895	.91	.73	.18
1896	.88	.81	.07
1897	1.31	1.35	.04
1898	1.24	1.40	.16
1899	.93	1.04	.11
1900	.90	.81	.09
1901	1.34	1.30	.04
1902	1.39	1.34	.05
1903	1.23	1.26	.03
1904	1.13	1.36	.23
1905	1.23	1.30	.07
1906	1.21	1.28	.07
1907	1.49	1.25	.24
1908	1.16	1.20	.04
1909	1.24	1.05	.19
1910	1.35	1.32	.03
1911	.90	1.02	.12
1912	1.29	1.25	.04
1913	1.13	1.14	.01
1914	1.23	1.20	.03
1915	1.17	1.30	.13
1916	1.45	1.62	.17
1917	1.52	1.46	.06
1918	1.16	1.25	.09
1919	1.19	1.40	.21
1920	1.21	1.25	.04
1921	1.02	1.01	.01
1922	1.37	1.40	.03
1923	1.14	1.36	.22

The average yield per acre was 1.22 tons. The largest deviation from actual yield was 0.24 ton per acre, and the smallest 0.01 ton per acre, thus the extreme deviations ranged from 480 pounds to 20 pounds per acre. The standard deviation of yield was 0.19 ton, while the average departure of computed yield from the actual was only 0.10 ton, a reduction of 0.09 ton, or about 47 per cent. The average departure of 0.10 ton means nearly 500,000 tons for the State, or about 8.2 per cent of the total production.

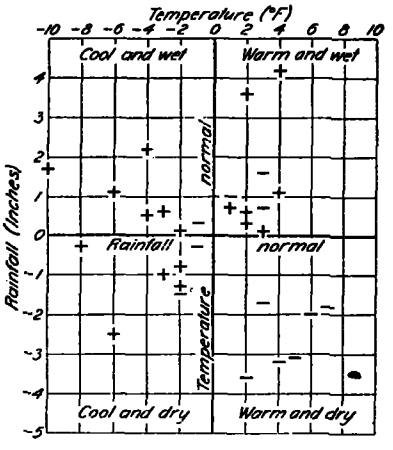

FIG. 1.—Relations between the yield of hay and certain rainfall-and-temperature combinations

SUMMARY

The weather of the spring months is the most important in hay production in New York State, and no single month is as important as a combination of months. The most important factor is the rainfall from April to June, inclusive, and the second in importance is the May to June mean temperature. The estimate of yield as computed from weather factors still leaves something to be desired, but averages 47 per cent closer than the deviation of yield from the average.

LITERATURE CITED

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(2) WALLACE, H. A. AND SNEDECOR, GEORGE W.
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